Citect for Windows
Driver Specification Extract
Fins Driver

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1. Target Device(s) and Protocol

1.1 Introduction

This section defines the types of I/O Devices that are targeted by this driver.

1.2 Device Manufacturer

OMRON Corporation.

1.3 Device Definition

This driver will communicate with any OMRON programmable logic controller supported within the OMRON FINS network environment. This includes PLCs using the following interfaces:

- SYSMAC Link
- Ethernet
- Host Link/ Controller Link

1.4 Communications Method

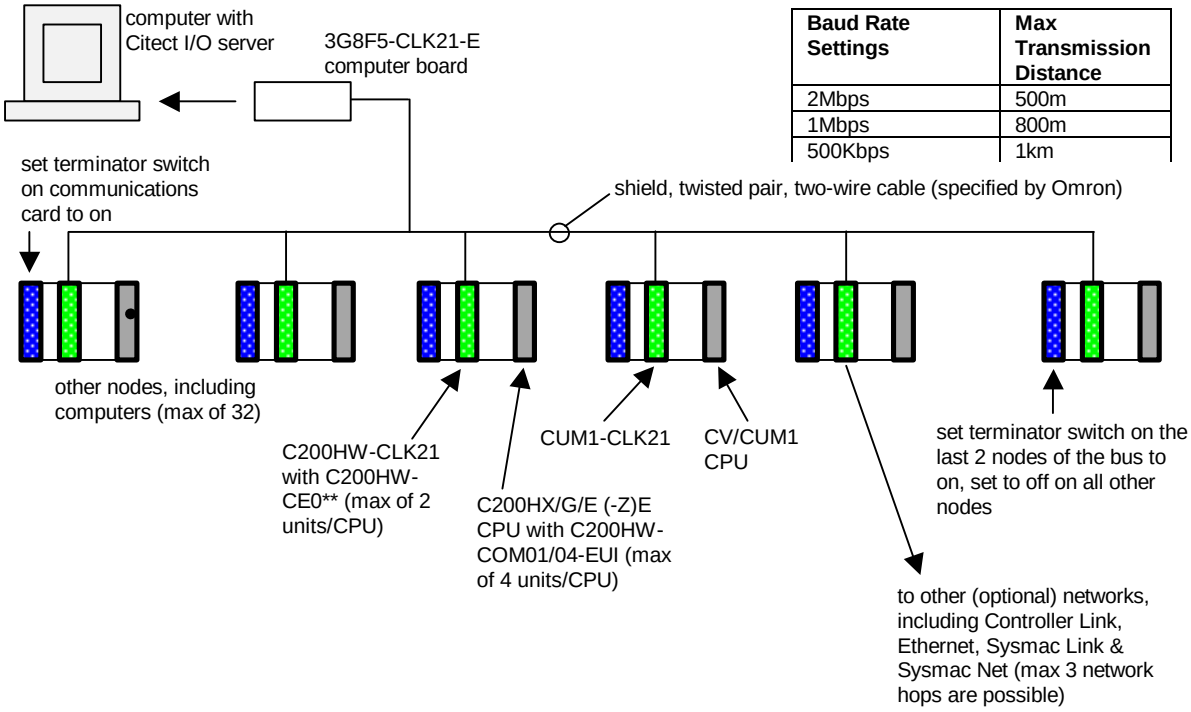
The driver communicates with OMRON PLCs via OMRON supplied “middleware” software running on the same computer as the driver. This “middleware”

- isolates the driver from dealing with specific communications methods such as serial or TCP/IP,
- allows the driver to communicate with any PLC as long as it’s interface is supported,
- provides routing and gateway functions between the driver and PLCs,
- provides an API for the driver via a DLL.

1.5 Controller Link (CLK) Networks

1.5.1 Wiring Diagram

Controller Link
(token bus architecture)


computer with Citect I/O server
3G8F5-CLK21-E computer board
set terminator switch on communications card to on
shield, twisted pair, two-wire cable (specified by Omron)
other nodes, including computers (max of 32)
C200HW-CLK21 with C200HW-CE0** (max of 2 units/CPU)
C200HX/G/E (-Z)E CPU with C200HW-COM01/04-EUI (max of 4 units/CPU)
CUM1-CLK21
CV/CUM1 CPU
set terminator switch on the last 2 nodes of the bus to on, set to off on all other nodes
to other (optional) networks, including Controller Link, Ethernet, Sysmac Link & Sysmac Net (max 3 network hops are possible)

Baud Rate Settings	Max Transmission Distance
2Mbps	500m
1Mbps	800m
500Kbps	1km

Notes:

- All nodes have 4 screw terminal connectors.
- The shield must be externally earthed at one location only.
- Data links can be configured for all nodes, including computers.

1.5.2 I/O Device Settings

Controller Link (hereafter referred to as CLK) is a 2-wire, token-passing bus network, supporting up to 32 nodes per network. Currently, only the CV/CVM1 & C200HX/G/E series of PLCs support CLK & both units will need hardware & software settings to be made. These are covered in sections 1.5.2.2 & 1.5.2.3 respectively. CLK networks support computer nodes (to run Citect) via a 3G8F5-CLK21-E interface board; as discussed in section 1.5.2.1.

The cabling needs to be connected so that all the terminals marked with black squares are connected together and the same for white square terminals, for all nodes. As the CLK network uses a bus architecture, the in-built terminator at each of the end nodes will need to be switched to ON. The terminators for all other nodes need to be switched OFF. These are shown below. The TER led on the node indicates the status of ~~if~~ the resistance. (Refer to Omron manual W309-E1-1, section 3.3 or more details on wiring, etc.

All nodes in a CLK network must have a unique station number, between 1-32. Also, the baud rate of the network is variable & all nodes all will need the same in order to communicate. A data link can be run between the PLCs simultaneously & transparently to Citect.

When a Controller Link network is operating properly, the Run & Ins LEDs will be lit on every single node. The SD & RD LEDs will flash or remain ON continuously. Ensure that neither the ERC & ERH LEDs should be lit. A complete fault finding guide is provided in Omron manual W309-E1-1, section 9.

1.5.2.1 3G8F5-CLK21-E Computer Board Set Up

The 3G8F5-CLK21-E is an ISA compliant computer board, which does not support "Plug-and-Play", when used in Windows 95. Node number & baud rate settings are made when configuring the I/O driver in Citect. There are only two hardware settings that need to be made on the board before installation:

- Interrupt Request (IRQ), set to either 10 (the default), 11, 12 or 15, but the setting must be unique for all other devices configured in your computer.
- Memory address, is set by a 4-pin dip-switch. One of 16 different memory areas can be configured, with base address C800(hex) being the default. Ensure that no other device or program requires the memory allocated by this setting.

Refer to Omron manual W307-E1-1, section 2.1 for more details for on these settings.

1.5.2.2 CVM1-CLK21 PLC Set Ups

A maximum of four CVM1-CLK21 units can be installed per CV/CVM1 system. They can be mounted anywhere on the CPU or CPU Expansion racks. Only three hardware settings need to be made:

- Unit number (00-15), which must be unique for all SIOUs connected to the PLC,
- Node Number (01-32), must be unique for all nodes on the CLK network
- Baud rate (2M, 1M or 500K), via pins 1 & 2 of the dip-switch bank. The default baud rate is 2Mb, allowing up to 500M cable to be run. (Refer to Omron manual W309-E1-1, section 4.2, for more details for this set up)

If more than one network is used, a network number (001-127) needs to be assigned to the CLK, in the PLC. Full routing tables will need to be set up if inter-network communications are required. Both these setting can be made by Syswin; from the Project|Routing Table dialogue. (Refer to Omron manual Syswin-Eman-3.2, pages 8.25-8.27, for more details).

1.5.2.3 C200HW-CLK21 PLC Set Ups

A maximum of two C200HW-CLK21 units can be installed per C200HX/G/E system. They must be mounted on the right most slot of the CPU rack. A C200H-COM01/04 board & a C200HW-CE0** bus must be used to connect the CLK21 unit to the CPU. Only three hardware settings need to be made:

- Node Number (01-32), must be unique for all nodes on the CLK network
- Baud rate (2M, 1M or 500K), via pins 1 & 2 of the dip-switch bank. The default baud rate is 2Mb, allowing up to 500M cable to be run. (Refer to Omron manual W309-E1-1, section 4.1, for more details for this set up)
- Level number (0 or 1), via pin 4of the dip-switch bank which must be different from the other SIOU connected to the PLC.

If more than one network is used, a network number (001-127) needs to be assigned to the CLK,in the PLC. Full routing tables will need to be set up if inter-network communications are required. Both these setting can be made by Syswin; from the Project|Routing Table dialogue. (Refer to Omron manual Syswin-Eman-3.2, pages 8.25-8.27, for more details).

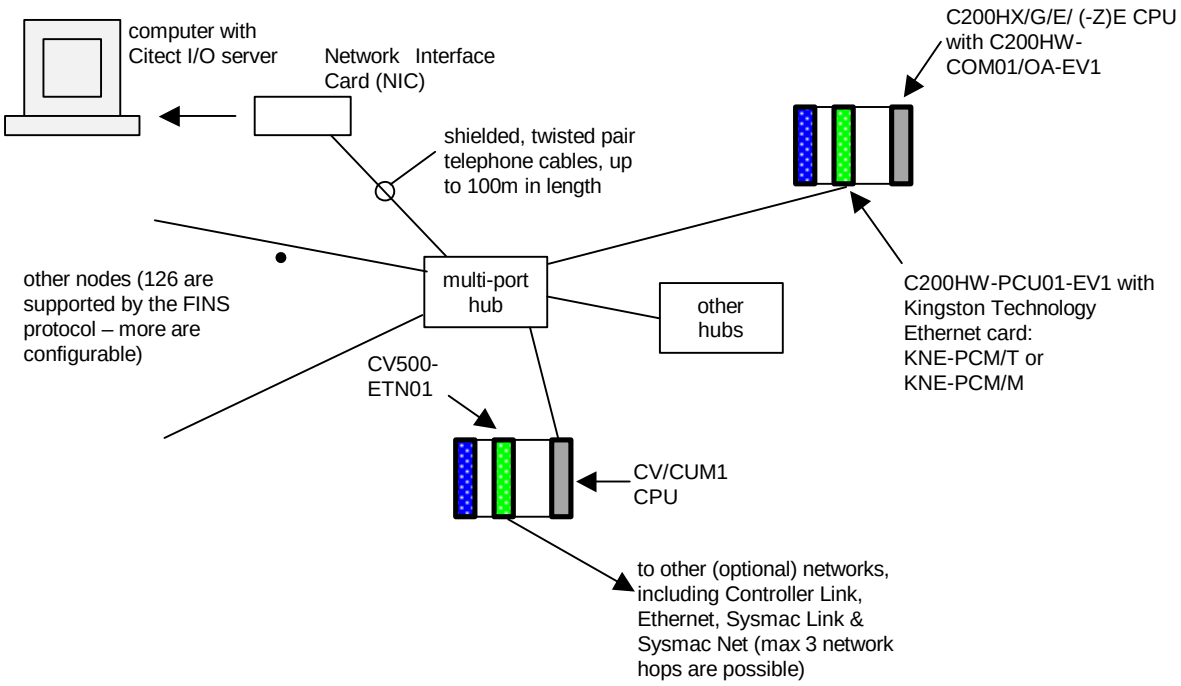
1.5.3 Software Setup

Refer to section 1.8.3 "Software Setup & Configuration" which is common to all supported OMRON network types.

1.6 Ethernet (ETN) Networks

1.6.1 Wiring Diagram

Ethernet
(10 Base T shown only)



Notes:

- 10M baud rate used throughout.
- 10 BASE 5 (ThickNet) supported by the CV500-ETN01 only.
- 10 BASE 2 (ThinNet) fully supported. It uses a bus type architecture.
- Data Links can not be configured in Ethernet systems.
- Automatic address resolutions are not supported, as each node has a table to map IP address to FINS address.

1.6.2 I/O Device Settings

Ethernet (hereafter referred to as ETN) is a standard industrial network supporting at least 126 nodes per network (more nodes can be configured, but these will not be able to communicate via the FINS protocol). Currently, only the C200HX/G/E & CV/CVM1 series of PLCs support ETN & both units will need hardware & software settings to be made. These are covered in sections 1.6.2.3 & 1.6.2.4 respectively.

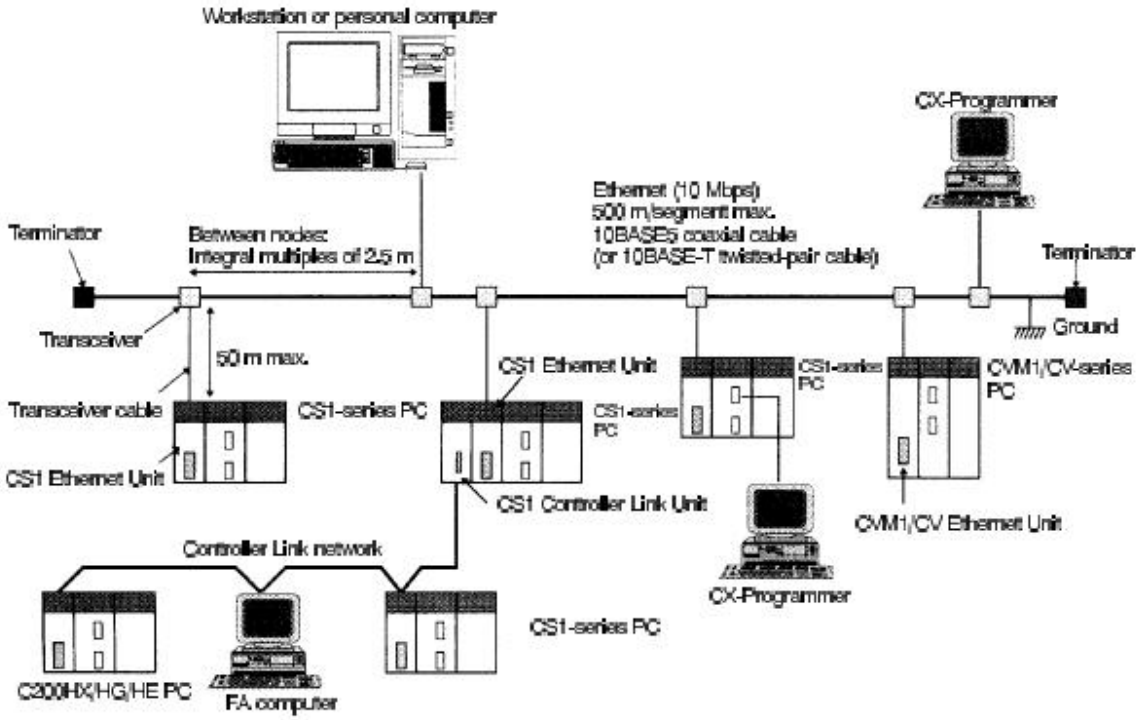
All communications between PLCs is via the FINS protocol, over UDP/IP. FINs uses a unique addressing system, which allows inter-network communications, amongst other things. The FINS address is unrelated to the IP node address used by Ethernet networks. Each node will therefore require a table to statically map FINS to IP addresses, as will be discussed. ARP, RAP or any other automatic IP address resolution system can not be used for nodes that need to communicate with PLCs.

When a Ethernet network is operating properly, the Run LED will be lit continually. After applying power the Run LED may take up to 20 seconds to turn on. Before this no communication will be successful. The SD, RD & the Card LEDs will flash occasionally. Ensure that the ERR LEDs is not lit. A complete fault finding guide is provided in Omron manual W313-E1-2, section 12.

1.6.2.1 Computer Node Set Ups

Please refer your computer documentation for all details, including set up, relating to its Ethernet interface board.

1.6.2.2 CS1 PLC Set Ups



Note
1. Transmission distance (from Terminator to Terminator): 500 meters/segment max.
2. When segments are indirectly connected by a repeater: 2.5 km/network
3. Node interval (from transceiver to transceiver): Integral multiples of 2.5 m
4. Transceiver cable length: 50 m max.

Three hardware settings need to be made:

- Unit number (00 – 15). The unit number is used to identify individual CPU Bus Units when more than one CPU Bus Unit is mounted to the same PC.
- Node number (1 – 126). With the FINS communications service, when there are multiple Ethernet Units connected to the Ethernet network, the Ethernet Units are identified by node numbers. Do not set a number that has already been set for another node on the same network.
- Local IP Address. The nodes on an Ethernet network are identified by IP addresses. Each IP address is set with 32 bits of binary data. These 32 bits are divided into four 8-bit fields called octets, and each octet is expressed as four decimal numbers. At the Ethernet Unit, four bits are expressed as on hexadecimal digit, and the eight hexadecimal rotary switches (the Local IP Address Switches) on the back of the Unit are used to set the local IP address.

After the hardware settings and connections have been completed, turn ON the power supply to the PC and create an I/O table. An I/O table is used to identify Units connected to the PC and to allocate I/O to them. If any change is made to the Unit configuration of a CS1-series PC, an I/O table must be created to register the Units to the CPU Unit. To create the I/O table, connect a Programming Device (such as a Programming Console or CX-Programmer) to the PC. Refer to the CX-Programmer User's Manual for an explanation of how to create an I/O table using a CX-Programmer.

When the FINS communications service is used, routing tables must be created in advance. The routing tables describe the transmission path for FINS messages when the FINS communications are used. Routing tables must be created by a CX-Programmer connected to the PC. For details on how to connect and use a CX-Programmer, refer to the CX-Programmer User's Manual.

The settings for the Ethernet Unit's basic and special functions are made in the CPU Bus Unit System Setup. For details on how to make the settings, refer to 4-2 CPU Bus Unit System Setup.

1.6.2.3 CV500-ETN01 PLC Set Ups

A maximum of four CV500-ETN01 units can be installed per CV/CVM1 system. They can be mounted anywhere on the CPU or CPU Expansion racks. CV500-ETN01 supports 10Base5 (ThickNet), 10BASE2 (ThinNet) and 10BASE2 (Twisted-pair), however, an appropriate MAU (Media Access Unit) needs to be installed on each ETN unit, for each network type.

Only two hardware settings need to be made:

- Unit number (00-15), which must be unique for all SIOUs connected to the PLC,
- Node Number (01-7E hex), must be unique for all nodes on the ETN network (For more details, refer to Omron manual W242-E1-1, section 2.2).

All other settings need to be made in the PLC, through the Syswin. Once the hardware has been correctly installed, it is generally best to connect Syswin through the serial port on the CPU (For more details on how to do this, refer to section 1.8.3).

Once online, settings can be made through the Project|Edit I/O Table menu. Once this menu is displayed, follow these steps:

- Press the "Create" to write all the I/O units & their locations into the CPU
- In the I/O table tree diagram, on the left hand side, the SIO Unit branch should be displayed in bold, indicating the ERTN unit has been detected. Highlight & expand this branch by clicking in the '+' symbol.
- The ETN unit should be registered along side its unit number. Highlight it & Click on the "Unit Setup" button. Any registered setting will now be read in from the ETN unit.
- The local IP address & Sub-net mask parameters must be filled in, in accordance of the network requirements.
- The following settings are generally the most appropriate ones, although for certain networks, different options may be required:
- Keep the FINS UDP Port number at its default value of 9600 (this will allow PLCs to communicate with each other.
- IP Address settings – Software switch
- IP Address Conv. Method - Table
- Click the "IP Ad Table" button to complete FIN to IP address mapping for each node in the network.
- When all settings have been made, click on the "Write" button to download them to the PLC.

(Refer to Omron manual Syswin-Eman-3.2, pages 6.2,3 & 8, for more details).

If more than one network is used, a network number (001-127) needs to be assigned to the ETN, in the PLC. Full routing tables will need to be set up if inter-network communications are required. Both these settings can be made by Syswin; from the Project|Routing Table dialogue. (Refer to Omron manual Syswin-Eman-3.2, pages 8.25-8.27, for more details).

1.6.2.4 C200HW-PCU01 PLC Set Ups

The C200HW-PCU01-E module handles Ethernet for the C200HX/G/E series. This unit is actually a 386SX computer & provides two PCMCIA slots, for mounting external memory modules (for high-capacity data storage) or Ethernet interface cards. Only 10BASE2 (ThinNet) & 10BASET (Twisted-pair) are supported, not 10BASE5 (ThickNet). A maximum of one PCU01 unit can be installed per C200HX/G/E system and only one of its slots can be used for an Ethernet PCMCIA module. It is highly recommended that the KNE-PCM/T PCMCIA module (made by Kingston Technologies) be used for the Ethernet interface. The PSU01 must be mounted on the right most slot of the CPU rack. A C200H-COM01/04 board & a C200HW-CE01* bus must be used to connect the PCU01 unit to the CPU.

Only one hardware setting needs to be made on the PCU01 & it involves the dip-switch bank on the front of the unit.

- Level number (0 or 1), via pin 1of the dip-switch bank. Ensure the level is different from the other Sysmac communication module in the PLC, if one is installed.
- Mode, set both pins 5 & 6 to off to communicate via Ethernet. The run led on the PCU will turn ON about ten seconds after powering the PLC up. (Refer to Omron manual W313-E1-2, section 4.3, for more details for this set up)

If more than one network is used, a network number (001-127) needs to be assigned to the PCU, in the PLC. Full routing tables will need to be set up if inter-network communications are required. Both these setting can be made by Syswin; from the Project|Routing Table dialogue. (Refer to Omron manual Syswin-Eman-3.2, pages 8.25-8.27, for more details).

1.6.2.4.1 Software Settings

All other settings need to be made in separate software, which is included in the C200HW-PCS01-EV1 package. To operate this software, power down the PLC, set pin 5 of the dip-switch bank to ON & turn on the power again. Connect a RS232 cable between COM1 of your computer & the RS232 port onboard the PCU01. (Refer to the cable mentioned in section 1.7.2.4 for more details). Install the set up software & run it (Refer to Omron manual W313-E1-2, sections 7.5 & 7.6). Ensure that no other software is running at the same time.

The following settings need to be made within the setup software:

- IP Address & Sub-net mask for the PCU01, as determined by the Ethernet network. These & other settings will be stored in a file called “Setup.fil”.
- ODI driver, (SPEC3 must be used, not SPEC4). This file is included in the Kingston PCMCIA card
- Host list – creates a file called “Hosts.fil”, listing all the nodes in the network
- IP to FINS address conversion table – saved in a file called “IP_Fins.fil”.
- Routing table, even if no routing table is used, the local network address must be set up to say “7 0” (These are actual keys entered in), where 7 would be the network number in this case. Relay network addresses need only be set is internode communications are necessary.
- Gateway address – if no Gateway address is required, enter “0 0 0 0”. (These are actual keys entered in)

When all these settings have been made, transmit them to the PCU01 unit. This will take around 30 minutes.

1.6.2.4.2 Checking/modifying the settings in the PCU01

Once all the files have been downloaded to the PCU01, settings can be checked and/or changed by following the procedure outlined below:

- Turn the power off the PLC & set both pins 5 & 6 on the PCU01 to ON. Turn the power back on the PLC. Note that the Run led on the PCU remains off.
- The PCU01 will now run MS-DOS, version 5.0 and can be monitored via a standard computer, running *Terminal* or *Hyperterminal*. The communications settings are: 9600 baud, 8 data bits, 1 stop bit & no parity bit. Connect a RS232 cable between the computer & the port on the PCU01 (not the PLC CPU). The cable required is the same as the one used in serial communications. Refer to section 1.7.2.4 for more details.
- Run a program in the PCU01 called *setup2*. This program accesses the parameters in the PCU01. Ensure that all parameters are checked, ie: that all the options are run at least once to view all parameters. (Changes may not be effectively made if this is not done).

```
1. Enter IP address for UNIT.
2. Enter Subnet address for UNIT.
3. Enter ODI Driver Path.
4. Edit HOSTS File.
5. Edit Conversion Table for IP address and FINS Node address.
6. Edit Routing Table for FINS.
7. Edit Gateway address for UNIT.
8. Uninstall.
9. Exit.

Select Number for ITEM(1-9) :
```

- Item 4, HOSTS file, all the nodes that you want to talk to the PLC, **including the PLC**, must be listed with a unique name, without spaces. It's a good idea to include spare nodes (as all nodes will need to be entered), but again, give them unique names without spaces.

```
Select Number for ITEM(1-9) : 4

Current HOSTS File Name : HOSTS
(0)192.168.10.1 PLC
(1)192.168.10.2 PC
(2)192.168.1.59 Spare node 9
(3)192.168.1.60 Spare node 10
(4)192.168.1.100 Spare PLC 0
(5)192.168.1.101 Spare PLC 1
(6)192.168.1.102 Spare PLC 2
(7)192.168.1.103 Spare PLC 3
(8)192.168.1.104 Spare PLC 4
(9)192.168.1.105 Spare PLC 5
```

- Item 5, FINS Table, all nodes need a "FINS address" (as well as the usual IP address) to be set up, so they can be addressed properly. The table in this step maps all the IP address to the FINS address. Usually make the FINS address

the same as the last segment of the IP address. The FINS address only goes to 127, so you will need to think of some arbitrary numbers for all your nodes.

```
Select Number for ITEM(1-9) : 5

Current IP address and FINS Node address : IP_FINS.FIL
(0)192.168.10.1 1
(1)192.168.10.2 2
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
```

- When all the changes have been made, exit from setup2 via option 9 in the software. Hangup the connection from the controlling computer & wait 5 seconds.
- Turn the power off the PLC & set pins 5 & 6 to off. Ensure that the Run led lights & the Err led does not light when you repower the PLC.

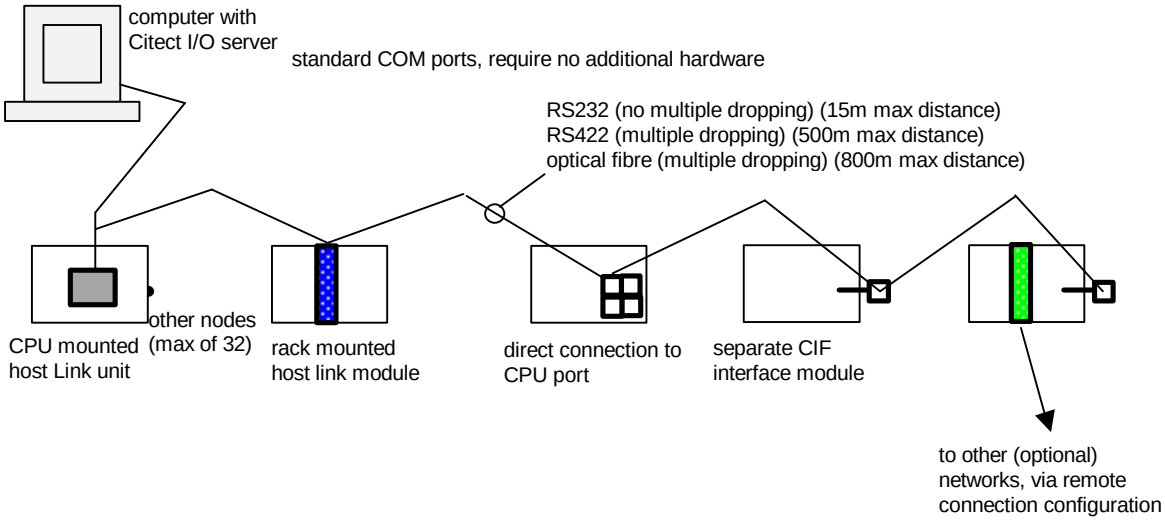
1.6.3 Software Setup

Refer to section 1.8.3 “Software Setup & Configuration” which is common to all supported OMRON network types.

1.7 Serial Communications

1.7.1 Wiring Diagram

Host Link Serial network
(Master / Slave architecture)



Notes:

- All C & CV series PLCs support the same protocol & can therefore be networked together.
- Interface adaptors can be freely used to convert interfaces between RS232 / RS422 or optical fibre.
- Omron Unit B500-AL004-EV1 is the recommended unit for this; it supports all three interfaces.

1.7.2 I/O Device Settings

All of the Omron C, CV & CVM1 series support serial communications, called Host Link. Host Link supports up to 32 PLCs (multi-dropped) & is available in either RS232, RS422 or optic fibre interfaces. As the protocol is exactly the same throughout, All Omron PLCs can be connected to one network and the various interfaces can be used interchangeably.

Host Link connections are made in one of two ways, either directly to the CPU or via some extra hardware. Set up for both methods is described below.

1.7.2.1 Hardware Devices

Listed below are all the Host Link hardware modules available & the PLCs they can be used on. When the Host Link unit is working properly, the run LED should be ON continuously & the RCV & XMT flash accordingly. The ERR led should always remain OFF.

Hardware	Applicable PLCs	Notes
CPM1-CIF*1	CPM1/A, SRM1, CQM1 & C200HX/G/E/S-(Z)E	Plugs into the peripheral port, available in RS232/422. Most settings need to be made in the software.
C200H-LK***	C200H only	Rack mounted module, available in all three different interfaces.
C200H-LK***-V1	C200H/S/E/G/X-(Z)E	Like the C200H-LK***, but supports that later CPUs
C500-LK***	C500/C1000H/C2000H	Rack mounted unit, providing both RS232/422
3G2A6-LK***	C**H/C200H/C500/ C1000H/2000H	CPU mounted unit, for the older modular PLC
3G2C7-LK20*-EV1	C20/C**K/C**P	CPU mounted unit, for the older block-type PLCs
CV500-LK201-EV1	CV/CVM1 series	Requires software settings through Syswin. Refer to Omron manual W205-E1-3
CS1W/G	CS1 series	Requires software setting through CX-Programmer. Refer to the CX-Programmer User's Manual for details.

As all dip-switch settings can be made on the actual units them & are clearly marked. The following notes must be observed when setting the dip-switches:

- Data parameters – the default host link setting is ASCII data, with 7 data bits, even parity & 2 stop bits.
- Baud rate – set all nodes on the network to the same baud rate.
- Unit number – set all the nodes on the network to a unique number between 00 & 31.
- Command Levels – enable levels 1, 2 & 3.
- Procedure – must be set to 1:N.
- Data format – ASCII

Other settings are generally inconsequential & should be left at defaults.

1.7.2.2 Basic Operation Procedure on CS1-Series PLCs

An overview of the basic operating procedure is provided here.

1. Turn OFF the power supply to the PLC.
2. Set the unit number if a Serial Communications Unit is being used. Set the unit number switch at the top of the front panel of the Unit to between 0 anf F. the number that is set will determine which words are allocated as the Setup Area in the DM Area and which words are allocated in the CIO Area.
3. Install the Board or Unit.
4. Connect the Unit and the external device(s).
5. Turn ON the power supply to the PC.
6. Create the I/O tables if a Serial Communications Units is being used. Creatd the I/O table using a Programming Device, such as CX-Programmer.
7. Set the serial communications mode and the communications specifications for the Board or Unit. Use a Programming Device, such as CX-Programmer.
8. make the new settings in the Setup Area valid by performing one of the following.
   - ?? Turn the power OFF and then ON again. The Setup Area allocated in the DM Area will be read when the power is turned ON.
   - ?? Restart the Board by turning ON the Inner Board Restart Bit(A60800) or drestart the Unit turning ON one of the CS1 CPU Bus Unit Restart Bits (A50100 to A50115, where the bit number corresponds to the unit number).
   - ?? Restart the port on the Serial Communications Board by turning ON one of the Communications Board Port Settings Change Bits (A63601 for port 1 and A63602 for port 2) or restart the port on the Serial Communications Unit by turning ON one of the Communications Unit Port Settings Change Bits (A620 to A635: the word will be A620 + unit number and the bit will be bit 01 for port 1 and bit 02 for port 2).
   - ?? Execute the STUP(237) instruction. The Board or Unit Setup Area can be changed while the PC power supply is ON.

Refer to CS1 Serial Communication Board/Module Manual W336-E1-1 for more details.

1.7.2.3 CPU RS232 Ports

Most of the PLCs also have RS232 ports on board that CPUs, which can also be run in other nodes, to support different protocols or types of communications. The main mode is however Host Link & this is the only protocol supported by Citect.

Regardless of the software settings, all CPU RS232 ports (except the C**H series) are controlled by the bank of dip-switches on the front of the CPU. The ports can be set to Host Link, with “default” parameters, by turning ON pin 5 (for the CQM1 & C200HS/E/G/X series) or pin 4 (for the CV/CVM1 series). The default settings are: 9600 baud[1], 7 data, even parity & 2 stop bits and these can be used to establish communications. (The C**H series requires DM0920 to be set to 0 to enable the default communication parameters).

When these respect pins are turned OFF, the CPU port will run with its software settings, which are described below:

Channel	Description	Setting
N	Port mode setting: use Host Link, with software settings	0001
N + 1	19200 baud, 7 data, even parity & 2 stop bits	0304
N + 2	Leave at 0000	0000
N + 3	Station node number, between 00-31	00**
N + 4	Reserved, leave at 0000	0000

[1] Some older PLCs use 2400 as their default baud rate

Value of channel N	Applicable CPU port
DM6645	RS232 port onboard: C200HX/G/E/S, CQM1 & SRM1
DM6650	Peripheral port, using a CPM1-CIF*1 interface, for CPM1, SRM1, CQM1 C200HX/G/E/S
DM6550	Port B, on the COM board, for the C200HX/G/E series
DM6556	Port A, on the COM board, for the C200HX/G/E series

When communications are in progress, the COM led on the CPU will flash. This led may be shared amongst several ports.

1.7.2.4 RS232 Cable Connections

While several cables can be configured, the cables below ~~will~~ are correct for all PLCs & can be used by both Citect & Syswin. Note that the C**H series has a 9-way connector but uses the same wiring assignment as the 25-way connector.

```
Computer (25 pin female)     PC (9pin male)
TD  2-------------------------3 RD
RD  3-------------------------2 TD
SG  7-------------------------9 SG

RTS 4--|                    |--4 RTS
CTS 5--|                    |--5 CTS

DTR 20-|
DSR 6 -|

Computer (9 pin female)     PC (9pin male)
RD  2-------------------------2 TD
TD  3-------------------------3 RD
SG  5----------------------|--9 SG {C200H(S), CQM1, CVM1 only}
                           |--7 SG {C20H, C40H, C60H, C28 only}
CTS 8--|
RTS 7--|                   |--4 RTS
                           |--5 CTS
DTR 4--|
DSR 6--|
```

Note: The OMRON DB9 pin connections vary between some C/CV series Controllers thus a universal DB9F cable linking pin 7 to 9 can be used.

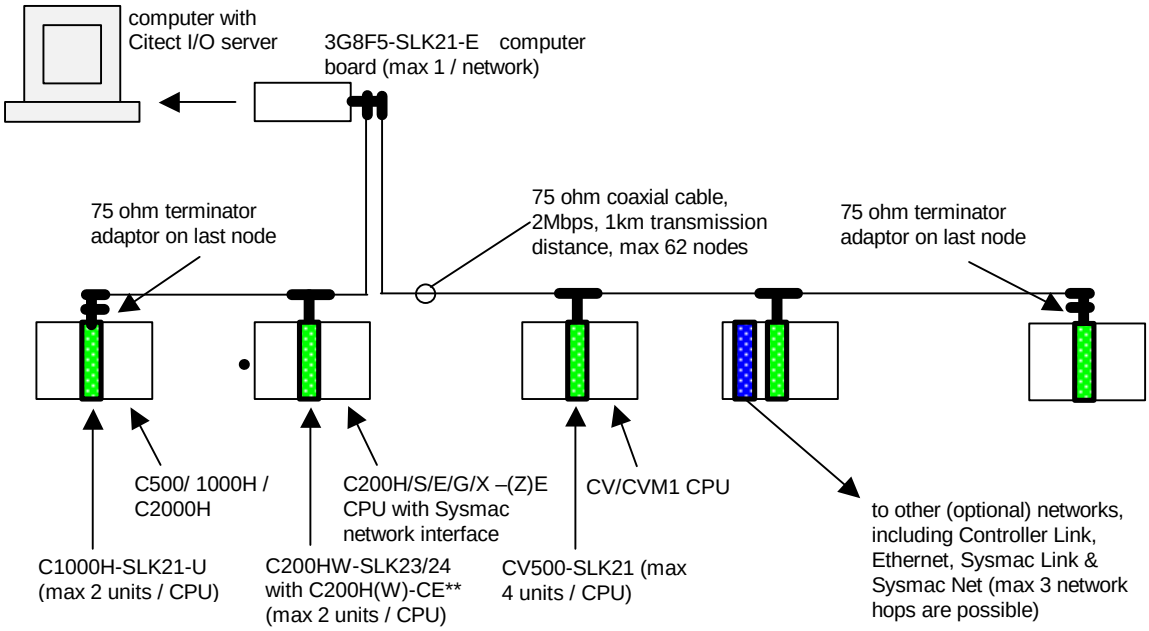
1.7.3 Software Setup

Refer to section 1.8.3 “Software Setup & Configuration” which is common to all supported OMRON network types.

1.8 Sysmac Link (SLK) Networks

1.8.1 Wiring Diagram

Sysmac Link
(token bus architecture)



Notes:

- Fibre optic Sysmac Link is not supported.
- The Sysmac network interface is provided by the C200HW-COM01/04-EV1 for the C200HX/G/E series.
- The maximum number of Sysmac Link units installed is reduced if other high speed communication units are installed.

1.8.2 I/O Device Settings

Sysmac Link (hereafter referred to as SLK) is a token-passing bus network, supporting up to 62 nodes per network. The CV/CVM1, C200HX/G/E C2000H/1000H & C200H/S series of PLCs support SLK, which need hardware & possibly software settings to be made. These are covered in sections 1.8.2.2 & 1.8.2.3. SLK networks support computer nodes (to run Citect) via a 3G8C2-SLK21-E interface board; as discussed in section 1.8.2.1.

Two cabling systems exist: coaxial (75?) & fibre optic. The bus architecture requires separate terminators to be installed in the end nodes for the coaxial system. As shown below. Terminators are not required in optical systems. (Refer to Omron manual W174-E1-4, section 3.3 or more details on wiring, etc. A fault finding guide is provided in section 9 of the same manual).

All nodes in a SLK network must have a unique station number, between 1-62 & this is set up on the hardware. A data link can be run between the PLCs simultaneously & transparently to Citect.

When a Sysmac Link network is operating properly, the Run & Ins LEDs will be lit on every single node. The SD & RD LEDs will flash or remain ON continuously. Ensure that neither the TS, ERC & ERH LEDs are lit. A complete fault finding guide is provided in Omron manual W174-E1-4, section 8.

If more than one network is used, a network number (001-127) needs to be assigned to the CLK, in the PLC. Full routing tables will need to be set up if inter-network communications are

required. Both these setting can be made by Syswin; from the Project|Routing Table dialogue. (Refer to Omron manual Syswin-Eman-3.2, pages 8.25-8.27, for more details).

1.8.2.1 3G8C2-CLK21-E Computer Board Set Up

The 3G8F5-CLK21-E is a ISA compliant computer board, which does not support "Plug-and-Play", when used in Windows 95. Node number settings are made when configuring the I/O driver in Citect. There are only three hardware settings that need to be made on the board before installation:

- Interrupt Request (IRQ), can be set to either 10 (the default), 11, 12 or 15, but the setting must be unique for all other devices configured in your computer.
- Memory address, is set by the 8-pin dip-switch. One of 4 different memory areas can be configured, with base address D800(hex) being the default. Ensure that no other device or program requires the memory allocated by this setting.
- Node number (01-62), is set by two rotary dials & must be unique for all nodes on the SLK network.

Refer to Omron manual W220-E1-1, section 2.3 for more details for these switch settings.

1.8.2.2 CVM1-SLK11/21 PLC Set Ups

A maximum of four CVM1-CLK21 units can be installed per CV/CVM1 system. They can be mounted anywhere on the CPU or CPU Expansion racks. Only two hardware settings need to be made:

- Unit number (00-15), which must be unique for all SIOUs connected to the PLC,
- Node Number (01-62), must be unique for all nodes on the SLK network

Refer to Omron manual W212-E1-1, section 2.2, for more details for this set up

1.8.2.3 C1000H-SLK11/21 And C200HW-SLK13/14/23/23 PLC Set Ups

A maximum of two of the above units can be installed per appropriate PLC system. C2000H/1000H-SLK units can be mounted on any slot on the CPU rack that supports communications. For all the C200H systems, SLK units must be mounted on the right most slot of the CPU rack. The C200H/S will require a CPU with Sysmac communications & a C200H-CE0** bus. The C200HX/G/E will require a C200H-COM01/04 board & a C200HW-CE0** bus must be used to connect the SLK21 unit to the CPU.

For all SLK units two hardware settings, need to be made:

- Node Number (01-62), is set buy the must be unique for all nodes on the SLK network
- Both units have dip-switches to set the level number (0 or 1), which must be set to be different to other SIOUs connected to the PLC. It is important that all other pins indicated as test switches, be left in the OFF position, as requested.

Refer to Omron manual W174-E1-4, section 2, for more details on the mounting positions & setting up of these units.

1.8.3 Software Setup

Refer to section 1.9 "Software Setup & Configuration" which is common to all supported OMRON network types.

1.9 Software Setup & Configuration

This section describes software setup & configuration for OMRON middleware software redistributed with Citect to support the FINS driver. There is a separate set of files for each of CLK/ ETN/ serial/ SLK interfaces.

***** only CLK interfaces are currently described by this document**

1.9.1 Minimum Requirements

- Windows NT4.0 or Windows 95
- PC/AT compatibles
- Intel Pentium CPU, 90 MHz or faster
- 32 MB or more RAM
- 6 MB or more disk space (for OMRON software only)

1.9.2 Setup

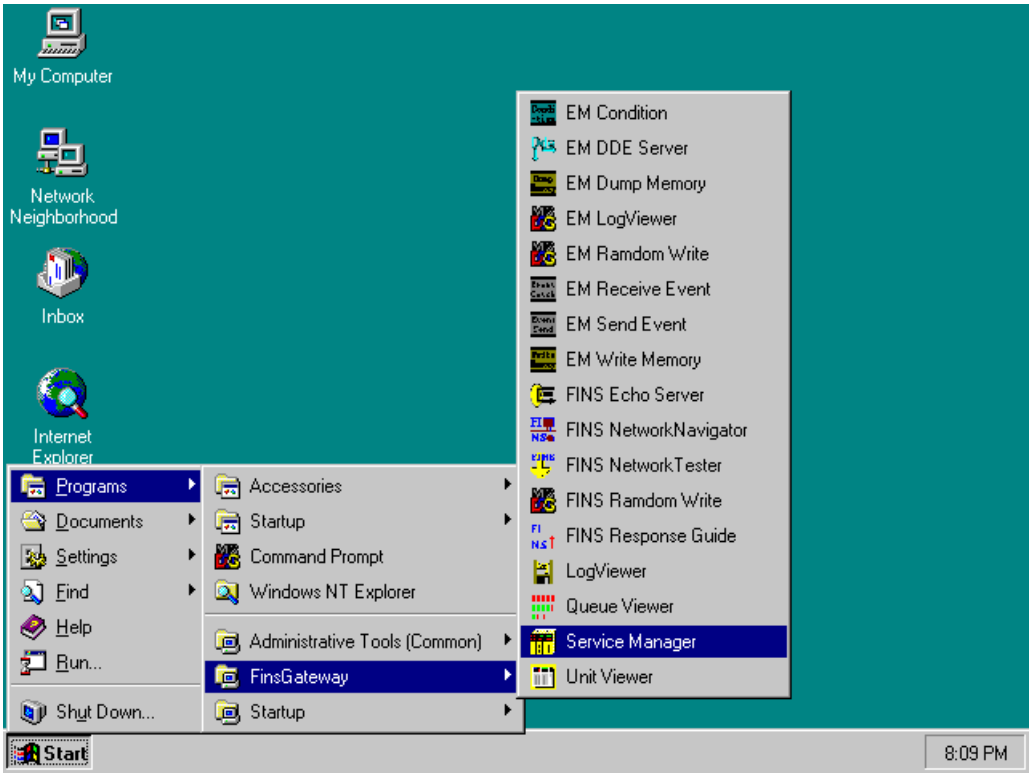
- Determine the hard disk directory into which software is to be installed. The disk space is approximately 6 MB. Unless you specify otherwise, the software will be installed in the default directory "C:\Program Files\OMRON\FinsServerNT" or "C:\Program Files\OMRON\FinsServer95".
- Determine the IRQ and shared RAM area address of the Controller Link support board that is to be installed. Ensure that they do not conflict with any existing boards.
- Login your system as "Administrator" group.(on WindowsNT only)
- Create 2 temporary directories c:\temp\disk1 and c:\temp\disk2. Copy the following files:

	Windows 95		Windows NT4.0	
Interface	copy ZIP file to disk1 directory	copy ZIP file to disk2 directory	copy ZIP file to disk1 directory	copy ZIP file to disk2 directory
for CLK network for ETN network for serial network for SLK network	clw95dk1.zip	clw95dk2.zip	clnt4dk1.zip	clnt4dk2.zip

- Uncompress each file into the same directory.
- disk1 will contain a setup.exe. Run this file. Proceed with the installation according to the directions given. The only item to decide in the installation is the directory in which to install the program.
- The system must be rebooted when setup is completed.

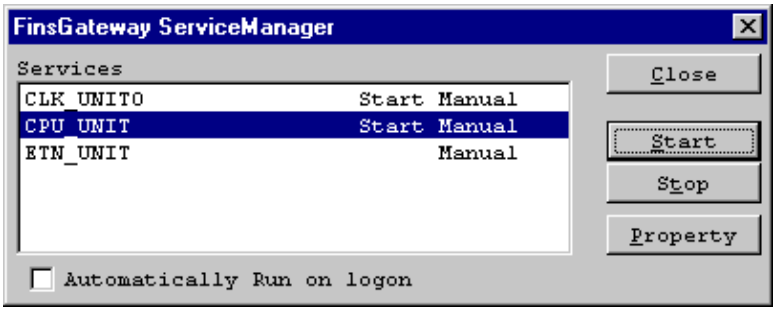
1.9.3 Starting "Service Manager"

The setup process will create a setup of menu items on the startbar. Refer to the following screen capture.



Run the “Service Manager” program. An icon will appear in the tray of the Task Bar. When this icon is right-clicked, a menu containing the items “Setting” and “Terminate” will be displayed.

Select “Setting” from the menu and start the required services from the dialog box by selecting a service and clicking on the start button. CPU_UNIT is always required and should always be started[2]. CLK_UNIT0 is required when Controller Link is used.



Services that have started normally will be indicated by "Start" next to the service name. If the Status column for a selected service does not indicate "Start" or an error dialogue box appears, the nature of the error can be checked on WindowsNT using the “Event Viewer” on the menu “Administrative Tools”. With Windows9x, the error is checked with ***[3].

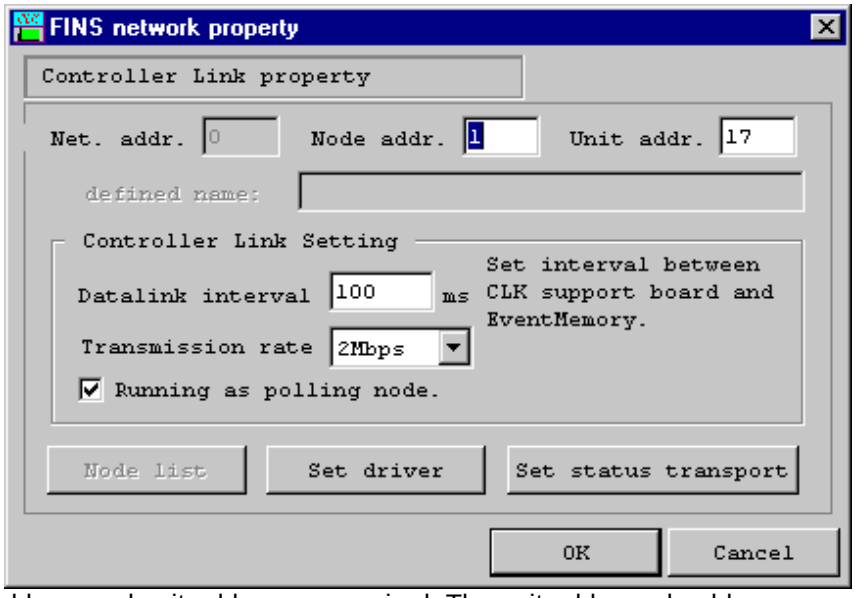
Services can be automatically started when the computer is powered up. Check the box “Automatically Run on logon” to automatically start the Service Manager, and select each service, click Property button, and set Execute Type to Auto.

[2] the order of starting services doesn’t matter
[3] Windows95 doesn’t have an event log, not sure how errors are logged

When setting automatic startup, first check that the services start and operate normally by manual starting. If automatic startup is specified even though there is a problem, the system itself may fail to start.

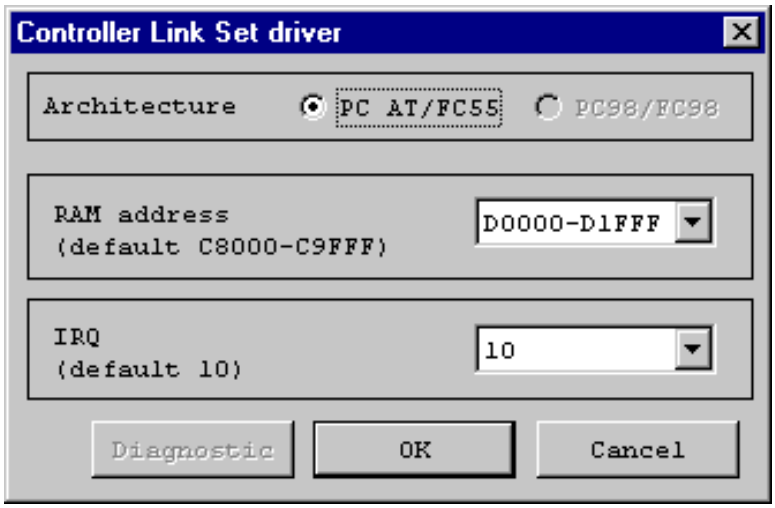
1.9.4 Controller Link Settings

Run the “CLK Network Config” program from Programs / FinsGateway group on startbar to modify Controller Link settings. The following dialog box will be displayed (exact settings will vary):



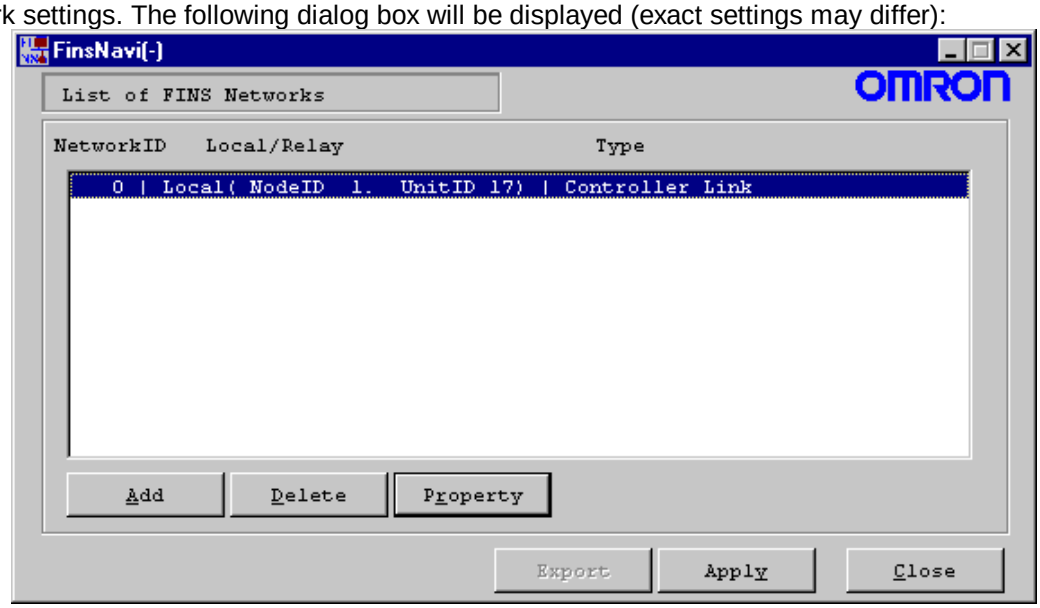
Set the node address and unit address as required. The unit address should correspond to the two thumbwheel switches on front of the CLK21 panel. The network address is set with the “FINS Network Navigator” program after starting the CLK_UNIT0 service, the network address is always displayed as 0 here.

The Controller Link Set Driver dialog box will be displayed when the Set Driver button is clicked. Set the same values for the IRQ and RAM area address of the Controller Link support board as the driver settings.

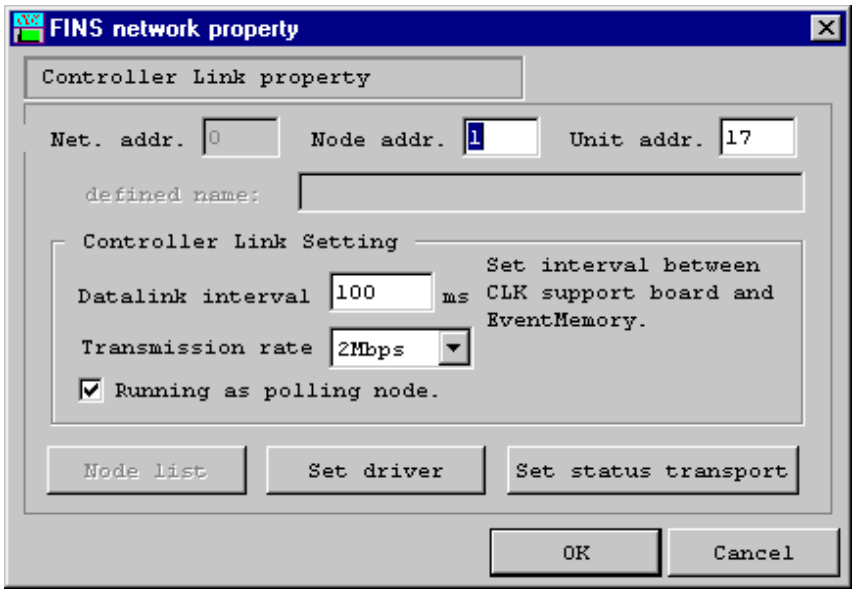


1.9.5 Network Settings

Run the “Fins Network Navigator” program from Programs / FinsGateway group on startbar to modify network settings. The following dialog box will be displayed (exact settings may differ):



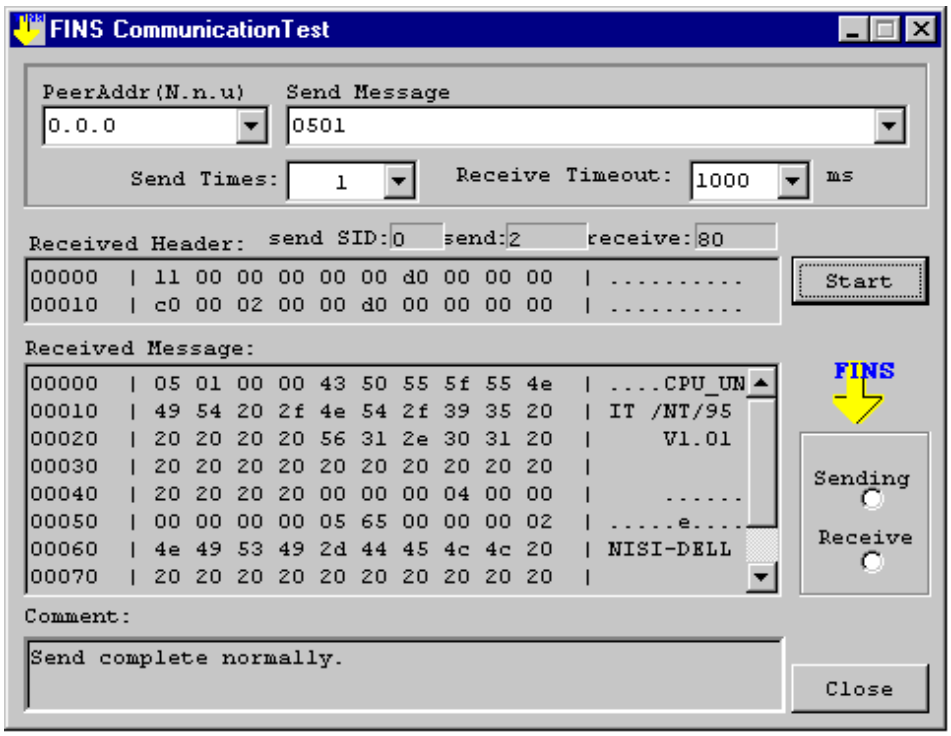
- Confirm that the required (network/ service/ interface) is listed in Network Information. Network Information indicates the configuration of current networks; i.e., network address, node address, and unit address. In this example, the network address is 0, the node address is 1, and the unit address is 17.
- ‘0’ can be used for the network address (indicates default network) only when one network exists. When two or more networks a (e.g. Ethernet and Controller Link), a non-zero address must be assigned to each network. The OMRON convention is 2 for serial, 4 for CLK and 7 for ETN networks.
- Select the network, then press the Property button. For example, the following dialog box will be displayed for a Controller Link network (the network address is normally enabled):



- Press the Add button when configuring relay networks.
- Press the Apply button upon completion of configuring networks. The network address set will not become valid until the Apply button is clicked, then click Yes to confirm the Routing Table change. This step must always be performed after making any change.
- Click Close button.

1.9.6 Confirming Communications Operations

Run the “Fins Network Tester” program from Programs / FinsGateway group on startbar to conduct simple communications within the node. The following dialog box will be displayed:



The PeerAddr textbox contains the address to the device to which a message will be sent. Two addresses are relevant to testing, the Controller Link address (eg. 0.0.17), but more importantly the CPU address (eg. 0.17.0).

- Set the PeerAddr textbox to Controller Link address.
- Set the message as "0501" (to read the controller information).
- Click the Start button.
- The received message textbox will display the CLK response if the system is operating correctly.
- Set the PeerAddr textbox to CPU address.
- Click the Start button.
- The received message textbox will display the CPU response if the system is operating correctly.
- Change Send Times to INFINITE, click Start again and observe rapid sending/receiving of messages. “send SID” field should increment from 00 to FF continually within 10 seconds without errors.

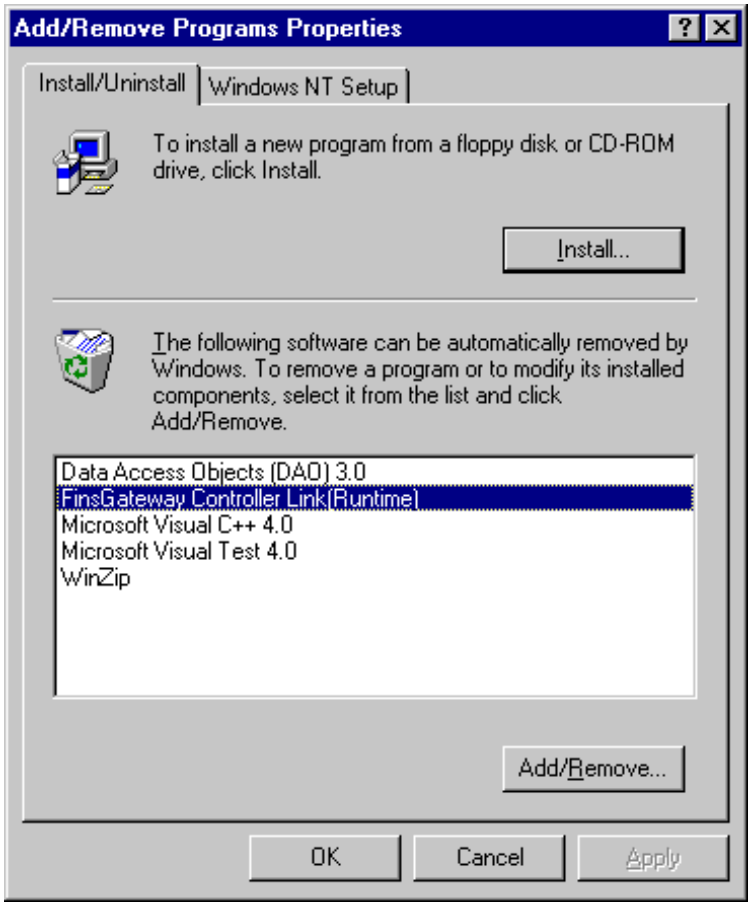
1.9.7 Uninstalling

Before uninstalling:

- any Citect project must be exited
- all running OMRON services must be stopped
- the Service Manager must be terminated - run the “Service Manager” program from Programs / FinsGateway group on startbar if not already running, right-click on tray icon and selected Terminate from context menu

Then,

- Run “Add/Remove Programs” program from Control Panel. The following dialog box will be displayed:


Add/Remove Programs Properties
Install/Uninstall
Windows NT Setup
To install a new program from a floppy disk or CD-ROM drive, click Install.
Install...
The following software can be automatically removed by Windows. To remove a program or to modify its installed components, select it from the list and click Add/Remove.
Data Access Objects (DAO) 3.0
FinsGateway Controller Link(Runtime)
Microsoft Visual C++ 4.0
Microsoft Visual Test 4.0
WinZip
Add/Remove...
OK
Cancel
Apply

- select the appropriate software to uninstall then click the Remove button
- after uninstallation, the computer will need to be rebooted

1.10 Syswin Programming Software

Syswin is the programming software used to program & configure all the Omron PLCs & networks. Version 3.2 is the latest version of Syswin & it runs on all networks that support programming. A simple upgrade is available for all 2.* & 3.* users.

Syswin is a 16-bit Windows application, meaning that it can be installed on Windows 31., 95 & NT (both NTFS & FAT). It requires around 8Mb RAM & 10Mb of hard disk space & numerous other requirements in your computer.

Syswin software is copy protected & requires either a hardware dongle or software token to operate. It is installed by running the *Setup* program from the first installation disk. For more information on the installation & copy-protection of Syswin, refer to Omron manual Syswin

V3.2 Users manual, pages 1-6 to 1-9. For more information on advanced installations (ie: running on networks or remote servers, etc), refer to chapter 11 of the same manual.

The cable configuration used for serial communications, by Syswin is exactly the same as that used by Citect & is shown in section 1.7.2.4. While Syswin can run simultaneously to Citect, it does not use the same communication drivers as Citect & can therefore not communicate to the same device at the same time.

Running Syswin over Ethernet only requires a standard Ethernet card, with all the appropriate settings made in Windows Control Panel, under networks. (Refer to page 8-10 of the Syswin Users manual for more details).

Syswin supports the Controller Link board, but only under Windows 3.1 & 95. This is because the vclkd.386 driver file needs to be loaded in the System.ini file, in the Windows directory. (This file is supplied in the master disks). Various other settings need to be made in the System.ini file. (Refer to page 8-10 of the Syswin Users manual for more details) Note that Citect can not use Controller Link when this file is installed.

Syswin also supports both Sysmac Link & Sysmac Net computer boards, but only when using Windows 3.1 or 95. This is because two MS-DOS based drivers need to be loaded in the config.sys file. Both these files are supplied with the software disk supplied with the actual computer board. (Refer to pages 8-8 & 8-9 of the Syswin Users manual for more details)

1.11 Miscellaneous Notes

The rest of the notes in section 3 are for specific OMRON PLCs are indicated.

1.11.1 SYSMAC Support Software set up:

- Install SSS SYSMAC Support Software to C:\SYSMATE, located in

  H:\CITECT\TESTING\PROTOCOL\OMFINS\SYSMATE ***
- Add to AUTOEXEC.BAT

  PATH = ... C:\SYSMATE
- Add to CONFIG.SYS

  DEVICE = C:\SYSMATE\SPDWADRV.DEV

  DEVICE = C:\SYSMATE\SPDTLDRV.DEV
- Run C:\SYSMATE\SSS.BAT
- Type S from the menu

  PC Model = CVM1-CPU21

  PC interface = host link

  SERIAL = COM1, 9600, 7, E, 2

  NET=000, NODE=000, NAME=""

Note: To connect to the controller type CTRL+O, followed by F1. If the device communications fails a communications error message will appear after the WATCH_DOG_TIMEOUT has expired.

1.11.2 OMRON CVM1 PC Settings:

- Set serial communications DIP switch to RS-232
- Set DIP switch settings behind front panel on host link of CVM1-CPU21 PC to:

DIP SWITCH	**DESCRIPTION**	**VALUE**
6	TERMINATION	0
5	AUTO BOOTING	0
4	HOST LINK DEF	1
3	HOST LINK	0
2	PERIPHERAL BAUD RATE	1 (9600)
1	PERIPHERAL BAUD RATE	0 (9600)

- Turn on power to PC after changes have been made while PC is off.

1.11.3 OMRON CV500-ETN01 Settings:

- Set front panel switches to the following:

  UNIT (01-15) note that 00 appears to be used for the CPU (eg. 01)

  NODE (1-126) must be unique for each ETN module(s) sharing a FINS network (eg. 06)

- Turn on power to PC after changes have been made while PC is off.

1.11.4 OMRON PS221 Power Supply Unit Wiring

The PS221 start input terminals need to be bridged to start data monitoring using CVSS. Otherwise a CVSS “CPU waiting” error will appear at some time, and will not disappear until this is done.

1.11.5 OMRON UDP Port/Socket address Setup

- By default the OMRON CV-Series uses a UDP port setting of 9600. (NB. if bit 04 of SIOU byte +1 is off, and UDP port number +16, +17 are also 0.
- To change the UDP port number do the following:
- Run SSS SYSMAC Support Software
- Press ESC, (to remove menu)
- Press CTRL+O, followed by F1 <online programming>, the banner will then show PROGRAM if successful.
- Select SSS Menu options as follows:
- Utility||CPU Base Unit Setup||CPU SIOU Unit System Setup, Note this menu option will not appear unless in PROGRAM mode
- Select UDP Port number (must be the same for all CV series that are to communicate with each other) range 1024 to 65535.
- Set the SIOU Memory array as follows:

  +01 [***1 ****] Enable non - default UDP port number bit 04

  +16 [**** ****] UDP High byte

  +17 [**** ****] UDP High byte

- Exit CVSS, press CTRL+O, followed by F1 <off-line programming>, the banner will then remove PROGRAM if successful.
- From the Setup menu exit (warning: exit option will be disabled if in PROGRAM mode).

1.11.6 OMRON ETN IP address Setup

- Select an IP address (eg205.122.56.6) note that the IP node address “d” must be the same as the FINS node address set on the front panel of the ETN module.
- Run SSS SYSMAC Support Software
- Use CTRL+O, followed by F1 <online programming>
- Select SSS Menu options as follows:
- Utility||CPU Base Unit Setup||CPU SIOU Unit System Setup
- Note this menu option will not appear unless in PROGRAM mode
- Select IP address a.b.c.d, where a,b,c,d are 8 bit numbers
- Set the SIOU Memory array as follows:

+08	[**** ****]	IP Address a.*.*.* as binary
+09	[**** ****]	IP Address *.b.*.* as binary
+10	[**** ****]	IP Address *.*.c.* as binary
+11	[**** ****]	IP Address *.*.*.d as binary
+12	[**** ****]	Subnet Mask 255.*.*.* as binary
+13	[**** ****]	Subnet Mask *.255.*.* as binary
+14	[**** ****]	Subnet Mask *.*.255.* as binary
+15	[**** ****]	Subnet Mask *.*.*.255 as binary

Note: Refer to Ref 1 Sec 2.6 Ethernet Unit System Setup for details

IP Address example: 205.122.56.1

ADDRESS INDEX	BINARY	HEX	DECIMAL
+08	[1100 1101]	0xCD	205
+09	[0111 1010]	0x7A	122
+10	[0011 1000]	0x38	56
+11	[0000 0001]	0x01	1
+12	[1111 1111]	0xFF	255
+13	[1111 1111]	0xFF	255
+14	[1111 1111]	0xFF	255
+15	[0000 0000]	0x00	0

1.11.7 OMRON CVM1-CPU Routing Table Setup

- Select a unique FINS network ID (1-127) for the each ETN module connected to the CPU BUS. (eg 2)
- Each ETN module on a CVM1 CPU bus will have a unique unit number (eg 01)
- The Network routing table of the CPU must be configured before communications can commence.
- The steps are as follows:
- Run SSS
- press [ESC]
- press [end], [up arrow] to advance to the Utility menu option Network Support Table
- Select R: Routing Table

  Loc Network # SIOU Unit #

  <FIN Net ID> <as per front panel of ETN>
- press [end] and select Edit routing table

  Note: if more than one ETN module is located on the CPU BUS then the table will need to be extended by selecting F1 Net #. Must Be off-line to do this.
- once values have been entered press F10 to return to menu
- Select Save Routing Table to C:\NEWRTR [enter], now the required configuration is saved to a file. (example in H:\CITECT\PROTOCOL\OMFINS\ROUTE.RTG)
- press CTRL+O on the main menu , followed by F1 to enter on-line monitor mode
- press [end], [up arrow] to advance to the Utility menu option Network Support Table
- Select R: Routing Table
- press [end] and select Transfer routing table (use defaults)

  Select transfer Computer -> PC (to down-load)
- press CTRL+O on the main menu , followed by F1 to enter off-line monitor mode
- Select from the main menu Set-up Exit
- Cycle power on the CVM1 PC to work with new values

1.12 Special Requirements

WINSOCK.DLL must be installed in Windows for UDP/IP communications.

TCPIP.DLL must be installed in Windows for TCP/IP communications.

1.13 Maximum Request Length

The maximum request length is 256 bytes.

2. User Interface

2.1 Introduction

This section defines how the user will see the driver. This relates directly to how the Citect forms need to be filled out and any special INI options. For the kernel, the debug trace messages and the Stats.Special counters are documented.

2.2 Driver Name

FINS

2.3 Boards Form

2.3.1 Board Type

FINS

2.3.2 Address

This value should be 0.

2.3.3 IO Port

Leave this field blank.

2.3.4 Interrupt

Leave this field blank.

2.3.5 Special Opt

Leave this field blank.

2.4 Ports Form

2.4.1 Port number

Enter a unique number.

2.4.2 Baud Rate

Leave this field blank.

2.4.3 Data Bits

Leave this field blank.

2.4.4 Stop Bits

Leave this field blank.

2.4.5 Parity

Leave this field blank.

2.4.6 Special Opt

Leave this field blank.

2.5 IO Devices Form

2.5.1 Name

Enter a unique name (different other IO device names with the same port name, could be blank if only 1 IO device).

2.5.2 Protocol

Enter FINS for C/CV-Series PLCs

Enter FINS3 for CS1-Series PLCs.

2.5.3 Address

Enter FINS CPU unit destination address in the form:

net.node.unit

where

- net is the FINS network address (1-127)
- node is the FINS node address (1-126)
- unit is the FINS CPU unit address[4] (0-15)

For example:

*4.17.0 (**NOT** 4.10.17)*

Note that the address is for the CPU unit **NOT** the serial/ CLK/ ETN/ or SLK unit. Refer to section 1.9.6 “Confirming Communications Operations” for address testing and confirmation.

2.6 Pulldown lists Help

The following entries should be included in the Citect HELP.DBF spec file.

TYPE	DATA	FILTER
BOARDTYPE	**FINS**	
PROTOCOL	**FINS**	
PROTOCOL	**FINS3**	

[4] the CPU is generally unit 0

2.7 IO Device Variable Types

2.7.1 Formats and types

2.7.1.1 For C/CV-Series PLCs

IO Device Type	Citect data format	Citect data types	Description/Special Usage/Limitations/ Valid Ranges
IO relay	n.b	INTEGER	0.0 to 2555.15
IO relay	CIOn.b	INTEGER	0.0 to 2555.15
IO relay word	CIOn	INTEGER	0 to 2555
data memory	Dn	INTEGER	0 to 24575
timer PV	Tn	INTEGER	0 to 1023
Counter PV	Cn	INTEGER	0 to 1023
step timer	STn	INTEGER	0 to 1023
bus link area	Gn	INTEGER	0 to 255
bus link area	Gn.b	INTEGER	0.0 to 255.15
auxiliary area	An	INTEGER	0 to 511
auxiliary area	An.b	INTEGER	0.0 to 511.15
Register area	Irn	INTEGER	0 to 2
Register area	DRn	INTEGER	0 to 2
timer completion flag	TFn	DIGITAL	0 to 1023, read-only
counter completion flag	CFn	DIGITAL	0 to 1023, read-only
step timer flag	STFn	DIGITAL	0 to 1023, read-only
action flag	Can	DIGITAL	0 to 2047, read-only
transition flag status	TNn	DIGITAL	0 to 1023, read-only
IO relay	N	DIGITAL	0 to 36815
link relay	LRn	DIGITAL	0 to 1023
Holding relay	HRn	DIGITAL	0 to 1599
timer / counter	TCn	DIGITAL	0 to 511
Status	Sn	DIGITAL	0 to 15
Error	En	DIGITAL	0 to 31
data memory	DMn	INTEGER	0 to 4095
timer / counter preset value	PVn	INTEGER	0 to 511

Where

- Valid ranges will vary between PLC models
- n is the decimal word address
- b is the bit address (0 to 15)

2.7.1.2 For CS1-Series PLCs

IO Device Type	Citect data format	Citect data types	Description/Special Usage/Limitations/ Valid Ranges
IO relay bit	n.b	INT,LONG,REAL	0.0 to 6143.15
IO relay bit	CIOn.b	INT,LONG,REAL	0.0 to 6143.15
IO relay word	n	INT,LONG,REAL	0 to 6143

IO relay word	CIOn	INT,LONG,REAL	0 to 6143
Data memory	Dn	INT,LONG,REAL	0 to 32767
Data memory	DMn	INT,LONG,REAL	0 to 32767
Degister area	DRn	INT,LONG,REAL	0 to 15
Timer PV	Tn	INT,LONG,REAL	0 to 4095
Timer completion flag	TFn	DIGITAL	0 to 4095, read-only
Holding relay word	HRn	INT,LONG,REAL	0 to 511
Holding relay bit	HRn.b	INT,LONG,REAL	0.0 to 511.15
Counter PV	Cn	INT,LONG,REAL	0 to 4095
Counter completion flag	CFn	DIGITAL	0 to 4095, read-only
Auxiliary area	ARn	INT,LONG,REAL	0 to 959 (0 – 447 read-only)
Auxiliary area	ARn.b	INT,LONG,REAL	0.0 to 959.15 (0.0 – 447.15 read-only)
Register area	IRn	LONG	0 to 15
Work area word	WRn	INT,LONG,REAL	0 to 511
Work area bit	WRn.b	INT,LONG,REAL	0.0 to 511.15

Where

- ?? n is the decimal word address
- ?? b is the bit address (0 to 15)

2.7.2 *driver.*dbf Entries

2.7.2.1 FINS.dbf for C-Series and CV-Series PLCs

TEMPLATE	UNIT-TYPE	RAW-TYPE	BIT-WIDTH	LOW	HIGH	COMMENT
A%U(0,0,511)	0	1	16	0	0	Auxiliary area, C series
A%U(0,0,511).%u(0,0,15)	1	1	16	0	0	Auxiliary area, C series, max A511.15
AC%U(0,0,2047)	2	0	1	0	0	Action Flag, Read Only
AR%U(0,0,27)	3	1	16	0	0	Auxiliary Relays, C series only
AR%U(0,0,27).%u(0,0,15)	4	1	16	0	0	Auxiliary Relays, C series only
C%U(0,0,1023)	5	1	16	0	0	Counter Present Value
CF%U(0,0,1023)	6	0	1	0	0	Counter Completion Flag, Read Only
%U(0,0,2555)	7	1	16	0	0	IO Relays words
CIO%U(0,0,2555)	7	1	16	0	0	IO Relays words
%U(0,0,2555).%u(0,0,15)	8	1	16	0	0	IO Relays, C series
CIO%U(0,0,2555).%u(0,0,15)	8	1	16	0	0	IO Relays, C series
D%U(0,0,24575)	9	1	16	0	0	Data Memory
DM%U(0,0,24575)	9	1	16	0	0	Data Memory
DR%U(0,0,2)	10	1	16	0	0	Register area
G%U(0,0,255)	12	1	16	0	0	Bus link area
G%U(0,0,255).%u(0,0,15)	13	1	16	0	0	Bus link area, max G255.15
HR%U(0,0,1599)	14	1	16	0	0	Holding Relay, C series, 1599=HR9915
HR%U(0,0,1599).%u(0,0,15)	15	1	16	0	0	Holding Relay, C series, 1599 =HR9915
LR%U(0,0,1023)	17	1	16	0	0	Link Relay, C series, 1023=LR6315
LR%U(0,0,1023).%u(0,0,15)	18	1	16	0	0	Link Relay, C series, 1023=LR6315
PV%U(0,0,511)	19	1	16	0	0	Timer/Counter Present Value
S%U(0,0,11)	20	1	16	0	0	Status
ST%U(0,0,1023)	21	1	16	0	0	Step Timer
STF%U(0,0,1023)	22	0	1	0	0	Step Timer Flag, Read Only

T%U(0,0,1023)	23	1	16	0	0	Timer Present Value
TC%U(0,0,511)	24	0	1	0	0	Timer / Counter
TF%U(0,0,1023)	25	0	1	0	0	Timer Completion Flag, Read Only
TN%U(0,0,1023)	26	0	1	0	0	Transition Flag status, Read Only
TR	27	1	16	0	0	
TR%U(0,0,7)	28	0	1	0	0	

2.7.2.2 FINS_CS1_Series.dbf for CS1-Series PLCs

TEMPLATE	UNIT-TYPE	RAW-TYPE	BIT-WIDTH	LOW	HIGH	COMMENT
AR%U(0,0,959)	3	1	16	0	0	Auxiliary Relays, AR000 -AR447 Read Only
AR%U(0,0,959).%u(0,0,15)	4	1	16	0	0	Auxiliary Relays, AR000 -AR447 Read Only
C%U(0,0,4095)	5	1	16	0	0	Counter Present Value
CF%U(0,0,4095)	6	0	1	0	0	Counter Completion Flag, Read Only
%U(0,0,6143)	7	1	16	0	0	IO Relays words
CIO%U(0,0,6143)	7	1	16	0	0	IO Relays words
%U(0,0,6143).%u(0,0,15)	8	1	16	0	0	IO Relays
CIO%U(0,0,6143).%u(0,0,15)	8	1	16	0	0	IO Relays
D%U(0,0,32767)	9	1	16	0	0	Data Memory
DM%U(0,0,32767)	9	1	16	0	0	Data Memory
DR%U(0,0,15)	10	1	16	0	0	Register area
HR%U(0,0,511)	14	1	16	0	0	Holding Relay
HR%U(0,0,511).%u(0,0,15)	15	1	16	0	0	Holding Relay
IR%U(0,0,15)	16	4	32	0	0	Register area
T%U(0,0,4095)	23	1	16	0	0	Timer Present Value
TF%U(0,0,4095)	25	0	1	0	0	Timer Completion Flag, Read Only
WR%U(0,0,511)	29	1	16	0	0	Work Area words
WR%U(0,0,511).%u(0,0,15)	30	1	16	0	0	Work Area bits

2.8 PROTDIR.DBF

TAG	FILE	BIT_BLOCK	MAX_LENGTH	OPTIONS
FINS	*FINS*	*2048*	*2048*	*0x3b*
FINS3	*FINS_CS1_Series*	*2048*	*2048*	*0x07b*

where 0x3b is equivalent to setting the following option bits:

OPT_DIGITAL	0x00001
OPT_INTEGER	0x00002
OPT_LONG	0x00008
OPT_BCD	0x00010
OPT_LONG_BCD	0x00020
OPT_REAL	0x00040

2.9 Parameters and INI options

2.9.1 Standard Parameters

Name	Default	Allowable Values	Comments
Block	256		
Delay	1	0 - 20	
MaxPending	2[5]	1 - 32	
Polltime	0		not used by driver
Timeout	1000	250 - 10000	(milliseconds)
Retry	1	0 - 5	
WatchTime	30		(seconds)

2.9.2 Driver Specific Parameters

None.

2.10 Remapping

Remapping is not provided.

2.11 Driver Specific Errors

No driver specific errors are used. All errors returned use generic error codes.

2.12 Driver Error Help

The following entries should be included in the Citect PROTERR.DBF spec file.

PROTOCOL	MASK	ERROR	MESSAGE	REFERENCE	ACTION	COMMENT

2.13 Debug Messages

None.

2.14 Stats Special Counters

Number	Label	Purpose/Meaning of this counter
0	Write	Number of Citect WriteDCB() requests
1	Read	Number of Citect ReadDCB() requests
2	StatusUnit	Number of Citect StatusUnit () requests
3	LastApiError	Last non zero error number returned from a FinsGateway API function call (refer para. 2.15.1 “Recovery From Power Failure **/ Cable Removal** It has been observed that the Omron middleware and FINS driver will recover very quickly from CLK cable removal. #COM will be displayed immediately the cable is removed, values will be displayed immediately the cable is reconnected.

[5] a value of 10 would occasionally result in "send buffer overflow" event log messages although no API error code

		It has been observed that the Omron middleware and FINS driver will recover very slowly from PLC power failure. After power is removed it appears that Omron middleware will cache values for 5 to 20 seconds before #COM is displayed. Once power is restored, it may take up to 3 minutes before the driver is performing at full speed. **OMRON API Return Codes**")
4	LastRespCodeMajor	Last non zero response code (1st byte) returned from a response message (refer para. **Error! Reference source not found.** "**Error! Reference source not found.**"
5	LastRespCodeMinor	Last non zero response code (2nd byte) returned from a response message (refer para. **Error! Reference source not found.** "**Error! Reference source not found.**"
6	Transmit	number of Fins_sendData()'s
7	Receive	number of Fins_receiveData()'s
8	ActiveReqs	number of outstanding requests
9	SIDMatchError	
10	LastRespCodeMinor	number of InitUnit()'s

2.15 Hints and Tips

2.15.1 Recovery From Power Failure / Cable Removal

It has been observed that the Omron middleware and FINS driver will recover very quickly from CLK cable removal. #COM will be displayed immediately the cable is removed, values will be displayed immediately the cable is reconnected.

It has been observed that the Omron middleware and FINS driver will recover very slowly from PLC power failure. After power is removed it appears that Omron middleware will cache values for 5 to 20 seconds before #COM is displayed. Once power is restored, it may take up to 3 minutes before the driver is performing at full speed.

2.15.2 OMRON API Return Codes

See reference 1. para. 6.1.1. Displayed in Stats Special Counter #3.

Code	Definition	Meaning
1	NOT_SUPPORTED	service is not supported
2	INVALID_HANDLE	incorrect network handle
3	NOT_ENOUGH_MEMORY	impossible to execute because of memory shortage
4	ENTRY_ALREADY_EXISTS	unit of the same unit address already exists
5	NETWORK_BUSY	network busy
6	BUFFER_OVERFLOW	receiving buffer overflow
7	DATA_SIZE_TOO_LONG	data size is out of range to handle
8	INVALID_FINS_HEADER	incorrect FINS header
9	RECEIVE_TIMEOUT	receiving time out
10	ILLEGAL_SID	invalid SID setting
11	NOT_SUPPORTED_VERSION	version is not supported; impossible to execute
12	BAD_NETPATH	wrong setting of routing table; can't reach final network

13	ROUTE_ILLOGICAL	routing table abnormal
14	CONSUME_GCT	allowed number of gateways exceeded
15	VERSION_ALREADY_LOCKED	version already in locked state and can't change
16	NO_RESPOND	attempted to make header to response
17	NOT_NEED_ACK	attempted to make response to command which requires no response
18	EVENT_CREATE_FAILED	couldn't make event object to be used for send data notice
19	LIST_CREATE_FAILED	couldn't make event object to be used for send data notice (duplicate?)
20	WAIT_MUTEX_FAILED	failed in stand-by process of exclusive control of shared memory
21	MEMORY_MAPPING	failed in mapping of shared memory
22	NAME_TOO_LONG	name of object is too long
23	DETACH_FREE_UNIT	attempted to release unused unit address
24	UNEXPECTED_FAILED	unexpected error occurred
25	MEMORY_INITIALIZE_FAILED	failed ~~to~~ initialisation of shared memory
26	MEMORY_ATTACH_FAILED	failed in attachment of shared memory
27	NO_MORE_ENTRY_UNITS	number of units (units) simultaneously useable exceeded
28	NO_PEER_UNIT	send destination unit id no existence
29	SEND_INFORM_FAILED	couldn't notify data transmission
30	WAIT_ABANDONED	exit from receive stand-by due to abnormal end of other process
31	RECEIVE_WAIT_FAILED	failed in receive stand-by
32	NO_MORE_HANDLE	all reserved area of network handle is fully used
33	NO_RECEIVE_DATA	incoming data is not received yet
34	INVALID_MESSAGE	invalid windows message type
35	POST_MESSAGE_FAILED	failed in message notice

2.15.3 OMRON PLC Response Codes

Displayed in Stats Special Counters #4 and 5.

Note that not all response codes apply to all PLCs.

Main Code	Sub-Code[6]	Probable Cause	Remedy
00: Normal Completion	00	---	---
	01	Service was interrupted	Check the contents of the destination transmission area of third code. Check the data link status.
01:Local node error	01[7]	Local node not part of network	Add to network.
	02	Token time-out, node number too large	Set the local node's node number below the maximum node number.
	03	Send error in local node was caused by lack of available space in internal buffers	Reduce the load (traffic) on the Ethernet Unit. Check your user applications.
	04	Maximum number of frames exceeded	Either check the execution of events in the network and reduce the number of events occurring in one cycle, or increase the maximum number of frames.
	05	Node number setting error (range)	Make sure the node number is within specified range and that there are no duplicate node numbers.
	06	Node number duplication error	Make sure that there are no duplicate node numbers.

[6] It appears from experience that the 2 most significant Sub-Code bits may contain error status indications. At one stage the C200HE CPU had its ERR LED flashing (non-fatal error) and this resulted in 00/40 Response Codes. The driver currently ignores these bits.
[7] This will be the response code when PLC power is removed.

02: Remote node error	01	IP address of remote node not set correctly in IP address table or IP router table	Set IP address of remote node into IP address table and, if inter network transmission is required, into the IP router table.
	02	No node with the specified unit address	Check the remote node's unit address and make sure the correct one is being used in the control data.
	03	Third node not part of network	Check the third node's node number.
		Broadcasting was specified	Check the control data and specify only one node as the third node.
	04	Busy error, destination node busy	Increase the number of transmit retry attempts or re-evaluate the system so that the destination node is not so busy receiving data.
	05	Message packet was corrupted by transmission error.	check the protocol and controller status by reading them with FINS commands. Increase the number of transmit retry attempts.
		Response time-out, response watchdog timer interval too short.	Increase the value for the response monitor time in the control data.
		The transmission frame may be corrupted or the internal reception buffer full.	Read out the error log and correct as required.
03: Communications controller error	01	Error occurred in the communications controller, ERC indicator is lit.	Take corrective action, referring to troubleshooting procedures in this section
	02	CPU error occurred in the PC at the remote node.	Check CPU indicators at the remote node and clear the error in the CPU (refer to the PC's operation manuals)
	03	A controller error has prevented a normal response from being returned	Check network communications status and reset the controller board. If the error still exists, replace the controller board.
	04	Unit number setting error	Make sure the unit number is specified within range and that the same unit number is not used twice in the same network.
04: Not executable	01	An undefined command has been used.	Check the command code and be sure the command is supported by the Unit to which you are sending it
	02	Cannot process command because the specified unit model or version is wrong	Check the unit model and version.
05: Routing error	01	Remote node is not set in the routing tables	Set the remote node in the routing tables
	02	Routing tables aren't registered completely	Set routing tables at the local node, remote node, and any relay nodes.
	03	Routing table error	Set the routing tables correctly, FINS services eg. CPU_UNIT may not be running

	04	The maximum number of relay nodes (2) was exceeded in the command.	Redesign the network or reconsider the routing table to reduce the number of relay nodes in the command. Communications are possible on three network levels, including the local network.
10: Command format error	01	The command is longer than the max. permissible length.	Check the command format of the command and set it correctly. Be sure broadcast transmissions don't exceed 1,473 bytes.
	02	The command is shorter than minimum permissible length	Check the command format of the command and set it correctly
	03	The designated number of data items differs from the actual number in the command data.	Check the number of items and the data and make sure that they agree
	04	An incorrect command format has been used	Check the command format of the command and set it correctly.
	05	Data for another node on the same network was received from the network	Check the header parameters in the command data and be sure the correct command format is being used.
		An attempt was made to send response data for a broadcast address.	

11: Parameter error	00	The parameters in the command data were incorrect or the UDP/TCP socket number was not within the proper range.	Check the parameters and be sure the socket number is between 1 and 8.
	01	A correct memory area code has not been used or Expansion Data Memory is not available	Check the command's memory area code and set the appropriate code.
	02	The access size specified in the command is wrong, or the first address is an odd number	Set the correct access size for the command.
	03	The first word is in an inaccessible area or the bit number is no 00.	Set a first word that is in an accessible area. The bit number must be 00 for Ethernet Units.
	04	The end of specified word range exceeds the acceptable range.	Check the acceptable limits of the data area and set the word range within the limits. Check the data link tables to be sure the limit to link words has not been exceeded.
	06	A non-existent program no. has been specified	Check the program number and be sure that it is set correctly.
	09	The sizes of data items in the command block are wrong	Check the command data and be sure that the sizes of the data items are correct. Check the data link tables to be sure all nodes in the refresh parameters are in the common link parameters.
	0A	The IOM break function cannot be executed because it is already being executed	Either abort the current IOM break function processing, or wait until it is completed and execute the command.
	0B	The response block is longer than the max. permissible length	Check the command format and set the number of items correctly.
	0C	An incorrect parameter code has been specified	Check the command data and renter it correctly. Check the data link table file for corruption.
22: Status error	0F	The same socket service is already in progress at the specified socket number.	Use the socket status flag in PC memory to be sure that socket service has finished before starting services again.
	10	The specified socket is not open	Open the socket. For TCP sockets, be sure to wait until connection is made.
23: Environment error	05	IP address conversion failed	Check the IP address and subnet mask in the System Setup and be sure that settings are correct.
	07	IP address conversion is set for automatic conversion only.	Check the mode settings in the System Setup. This error will be generated for the READ IP ADDRESS command only.

25: Unit error	03	I/O setting error (The I/O table differs from the actual Unit configuration.)	Either change the actual configuration to match the registered one, or generate the I/O table again.
	05	CPU bus error (An error occurred during data transfer between the CPU and a CPU Bus Unit.)	Check the Units and cable connections and issue the ERROR CLEAR command.
	0A	An error occurred during CPI Bus Unit data transfer.	Check the Units and cable connections and issue the ERROR CLEAR command.

3. References

3.1 References

- Omron manual W227-E1-1 - FINs Command Reference Manual, 6/93.
- Omron manual W309-E1-1 – PLC module Controller Link Operation Manual, 2/97.
- Omron manual W307-E1-1 – Controller Link Computer Board Operation Manual, 2/97.
- Omron manual W242-E1-1 – CV/CVM1 series Ethernet Operation Manual, 3/94.
- Omron manual W313-E1-2 – C200HX/G/E Ethernet Operation Manual, 1/97.
- Omron manual W143-E1-5 – C-Series Host Link Reference Manual, 6/96.
- Omron manual W182-E1-1 – C20/C**K Host Link Operation Manual, 8/90.
- Omron manual W174-E1-4 – PLC module Sysmac Link Operation Manual, 8/96.
- Omron manual W220-E1-4 – Sysmac Link Computer Board Operation Manual, 1/93.
- Omron manual Syswin-Eman-3.2 - Syswin version 3.2 Users Manual, 8/97

The respective PLC CPU Operation Manual is helpful too.

The following references are for Citect development use only and shouldn't be given to end users:

- FinsGateway FinsApi V1.2 Programmers Manual,
- FinsGateway CLK_UNIT V1.2 Runtime Edition Manual, 3/1/97
- FinsGateway ETN_UNIT V1.2 Runtime Edition Manual, 3/1/97
- FinsGateway Serial V1.2 Runtime Edition Manual, 3/1/97
- FinsGateway SLK_UNIT V1.2 Runtime Edition Manual, 3/1/97